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# Nuclear Weapons and the Atmospheric Test Era

Speaking before his alma mater, Pomona College, in late 1946, Norris Bradbury said*, "The paths of research and development during the war had to be limited to those that had the greatest possibility of success in the shortest possible time. The probability of an unforeseen obstacle requiring time to overcome had to be as low as human foresight would allow. Naturally, therefore, there remained a large number of promising avenues of weapon development that should be taken up and investigated."*[1] In these sentences, Bradbury described the entire Laboratory nuclear test program.

## Fission and Thermonuclear Weapons

As Bradbury also noted in his Pomona speech, there was "no *a priori* insurmountable obstacle" to building an atomic bomb.[2] The wartime task, then, was to produce one or more fission bombs that minimized the risk of failure in combat. By proving that fission could be weaponized, Trinity made both Little Boy and Fat Man possible.

Theoretically conceived in the summer of 1942, the first thermonuclear device, Mike was successfully detonated late 1952. Variations of Mike were tested during Operation Castle and the first production model hydrogen bomb during Operation Redwing.

In 1956 Los Alamos mathematician Stan Ulam commented that *"One cannot help feeling that the field of weapon design is being exhausted and at least without a relatively new idea, there will be no big surprises."*[3] Ulam's observation proved correct. All subsequent tests were a variation of fission and fusion devices.

## Tactical Weapons

As World War II came to end, politicians, military leaders, and even scientists suggested that atomic bombs could be used as tactical, or battlefield weapons. Both Crossroads and Wigwam explored the tactical uses of atomic bombs against naval vessels. Argus and Fishbowl explored the effects the Electromagnetic Pulse effects of high altitude detonations. At the Nevada Proving Ground, both an atomic cannon and a nuclear-tipped air-to-air missile were successfully tested.

## Safety

The increasing sophistication of nuclear weapons introduced the increased probability of an unintended accidental or purposeful detonation. Safety tests, whose purpose was to give little or

[1] Norris E. Bradbury, Peace and the Atomic Bomb, LA-UR-16-25417, p. 6. Also reprinted in The Physical Review (Volume 75, No. 8, 1154-1160, April 15, 1949).

[2] Ibid, 2.

[3] Ulam to von Neumann, Los Alamos Theoretical Division Memo, T-841, LANL Archives, June 20, 1956.

no yield when detonated, were the sole focus of Projects 56, 57, 58, and 58A. Safety tests were included in the Plumbbob test series as well both those of Hardtack I and II.

**Public Health**

International concern about the deleterious effects of radioactive fallout arose in the wake of Hiroshima and Nagasaki. This concern grew and intensified after Castle-Bravo's fallout injured Marshallese natives and the crew of a Japanese fishing vessel. Both the Atomic Energy Commission and Los Alamos explored ways of allaying that concern. Beginning with Teapot, the AEC included public health experiments designed to show how the general populace could survive a nuclear detonation. During Redwing, Los Alamos tested so-called "clean" versions of some devices. Such devices were designed to reduce fallout of fission products. Neither effort was successful.

**The Atmospheric Test Program**

The era of atmospheric testing defies a simple description. Beginning with the goal of proving fission, the United States' test program grew in complexity as scientists explored thermonuclear reactions, met the military demand for a variety of weapons for an increasing number of delivery platforms, and reacted to the ever-growing public fear of fallout. And, of course, political considerations were always present, first in the prosecution of World War II and later in the Cold War. To understand the atmospheric test program, then, is to understand how science, politics, and the public shaped our society in ways that are still difficult to fully understand.